

APPENDIX A: VERSION WITH MARKINGS TO SHOW CHANGES MADE

25. (Amended) An integrated circuit package comprising:
a tape carrier defining a thickness;
a first adhesive layer disposed on the tape carrier, the first adhesive layer having a coefficient of thermal expansion and a thickness;
a transition medium having a first surface and a second surface, wherein the first surface of the transition medium engages the first adhesive layer, the transition medium having a coefficient of thermal expansion and a thickness;
a second adhesive layer disposed on the second surface of the transition medium, the second layer of adhesive having a coefficient of thermal expansion and a thickness; **[and]**
a die disposed on the second adhesive layer comprising a thickness that is less than the thickness of the transition medium; and
a mold cap encapsulating the first adhesive layer, the transition medium, the second adhesive layer and the die, wherein the mold cap and tape carrier define a package thickness, wherein the thickness of the adhesive layer, transition medium and die is nearly equivalent to or the same as the half of the package thickness so as to reduce the stress on the die during thermal cycling, wherein the transition medium and the mold cap have approximately the same coefficient of thermal expansion so as to reduce the thermal stress on the die during thermal cycling.

49. (Amended) An integrated circuit package comprising:
an integrated circuit die having a front side, a back side, and a first thickness between the front and back sides, wherein bonding pads are formed on the front side;
a metallized polymer layer having a first side and a second side, wherein the bonding pads are electrically coupled to features of the metallized polymer layer; and

a transition medium, between the integrated circuit die and the metallized polymer layer, wherein the transition medium has a second thickness, greater [less] than the first thickness.

REMARKS

Claims 1-25 and 49-61 are pending. No claims are canceled. Claims 25 and 49 are amended. Claims 1-25 were rejected under section 103(a) as being unpatentable over U.S. Patent No. 5,866,949 (Schueller) and U.S. Patent 6,054,337 (Solberg). Claims 49-61 were rejected under section 102(a) as being anticipated by Schueller. Examination and reconsideration of all pending claims are respectfully requested.

No Suggestion to Combine

There is no suggestion to combine Schueller and Solberg. Schueller discusses a single chip package, and Solberg discusses a multichip package. There is no discussion in Schueller that the technique be used for a multichip package of Solberg to obtain benefits as desired by Schueller. There are numerous differences and inconsistencies between Schueller and Solberg, too many to list here. For example, in Schueller, a front face (with bonding pads) of the die 52 is facing away from substrate 83. In Solberg, both dies 350 and 364 have a front face facing toward substrate 320. Solberg has compliant pads 371 to support the first and second chips. This is not the same nonpolymer support structure 50 of Schueller. There is no discussion of how the nonpolymer support structure 50 of Schueller can be integrated with Solberg, especially since there are two chips and conductive traces 338 must connect chip 364 with substrate 320. If Schueller's nonpolymer support structure 50 were placed between the substrate 320 and the traces 338 (of Solberg), this would short out the conductors and the package would not be functional. Therefore, there is no suggestion in the references to combine Schueller and Solberg.

Even if Schueller and Solberg were combined, however, the combination of the references fall short of the present invention as recited in the claims.

Claims 1-25

In particular, claims 1-25 should be allowable over the prior art because Schueller and Solberg, individually and in combination, do not show or suggest each and every feature recited in the claims as discussed.

For example, claim 1 recites “the first thickness of the silicon die is less than the second thickness of the transition medium.” Schueller and Solberg do not show or suggest this.

Furthermore, claims 2-19 are dependent on claim 1 and should be allowable for at least similar reasons. These claims, however, further recite additional novel features and should also be allowable for these additional reasons. For example, claim 7 recites that the silicon die is disposed near the middle of the package thickness. As recited in the specification at page 2, lines 7-15 and page 9, line 32 to page 10, line 12 of the original specification, positioning the die near the middle of the package reduces the package warpage and curling by allowing the top and bottom of the package to contract more equally around the die such that the stress on the die is reduced and the overall life of the package is improved.

Claims 20-25 also recite features not shown or suggested in Schueller and Solberg. Claim 20 recites an integrated circuit package comprising a metallized polymer layer which defines a first thickness. A transition medium is coupled to the metallized polymer layer and a die is coupled to the transition medium. A mold cap encapsulates the transition medium and the die. The mold cap defines a second thickness such that the first thickness and second thickness define a package thickness in which the die is disposed near the middle of the package thickness.

Having the die being positioned near the middle of the package thickness provides advantages that are not described or suggested by the cited art. In particular, as recited in the specification at page 2, lines 7-15, the transition medium can absorb the mechanical and thermal stress from temperature cycling. Moving the die towards the center of the packaging with the transition medium allows the molding cap and transition medium to expand and contract while keeping the die relatively motionless in the center of the package. By moving the die towards the middle of the packaging, the transition

medium reduces the warpage and curling of the package and reduces the stress on the die. Such a combination that provides such benefits is not described or suggested by the combination of Schueller and Solberg.

Additionally, Applicant has amended claim 25 to more clearly claim the novel aspects of the present invention. In particular, claim 25 has been amended to recite that a thickness of the adhesive, transition medium, and die is nearly equivalent to or the same as half of the package thickness so as to reduce the stress on the die during thermal cycling and that the thickness of the dies is less than the thickness of the transition medium. Having the thickness of the adhesive, transition medium and die nearly equivalent to or the same as half of the package thickness provides advantages that are not described or suggested by the cited art. In particular, having such a configuration allows the mold cap and transition medium to expand and contract while keeping the die relatively motionless which reduces the warpage and curling of the package and reduces the stress on the die. Moreover, because there is less stress on the die, the die thickness can be reduced to less than the thickness of the transition medium, which further reduces the overall thermal mismatch stress on the package. Such a combination is not described or suggested by the combination of Schueller and Solberg.

In contrast to the packages recited in claims 20 and 25, Schueller shows a die which is not positioned near the middle of the package. Moreover, Solberg provides a package that has a larger first die adjacent a top end of the package and a smaller die adjacent a bottom end of the package. There is no description or suggestion of placing a die near a middle of the package thickness, nor is there a description or suggestion of a die having a thickness that is less than the thickness of the transition medium. Hence, claims 20-25 should be allowable over the cited art.

Claims 49-61

Independent claim 49 has been amended to more clearly claim the novel aspects of the present invention. Amended claim 49 recites an integrated circuit package comprising an integrated circuit die having a front side, a back side, and a first thickness.

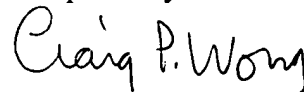
Bonding pads are formed on the front side. The bonding pads are electrically coupled to features of a metallized polymer layer. A transition medium is positioned between the integrated circuit die and the metallized polymer layer. The thickness of the transition medium is greater than the first thickness of the integrated circuit die. As described above, neither Schueller (nor Solberg) describe or suggest such an integrated circuit package. Therefore, claim 49 and its dependent claims 50-61 are allowable over the cited art.

In addition to relying on an allowable independent claim, dependent claims 50-61 further recite separately patentable elements. For example, claim 53 recites that the integrated circuit package accommodates only a single integrated circuit die. The cited art, alone and in combination do not describe or suggest such an integrated circuit.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is urged. If the Examiner believes a telephone conference would aid in the prosecution of this case in any way, please call the undersigned at 650-326-2400.

Respectfully submitted,



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